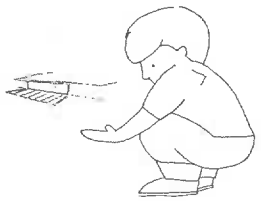


The Watershed Connection

Overview: Students use a poster of the Southern San Francisco Bay Watershed and maps to locate watersheds, creeks, rivers, and the "watershed address" of their school. Students learn about watersheds, runoff, and how pollution travels within a watershed by making a simple watershed model.

Content Standards Correlations: Science, p. 304, and History/ Social Science, p. 310

Grades: 4-6

Key Concept: Each of us lives in a watershed that flows into the San Francisco Bay. What we do at home and school can have an effect on the health of the Bay.

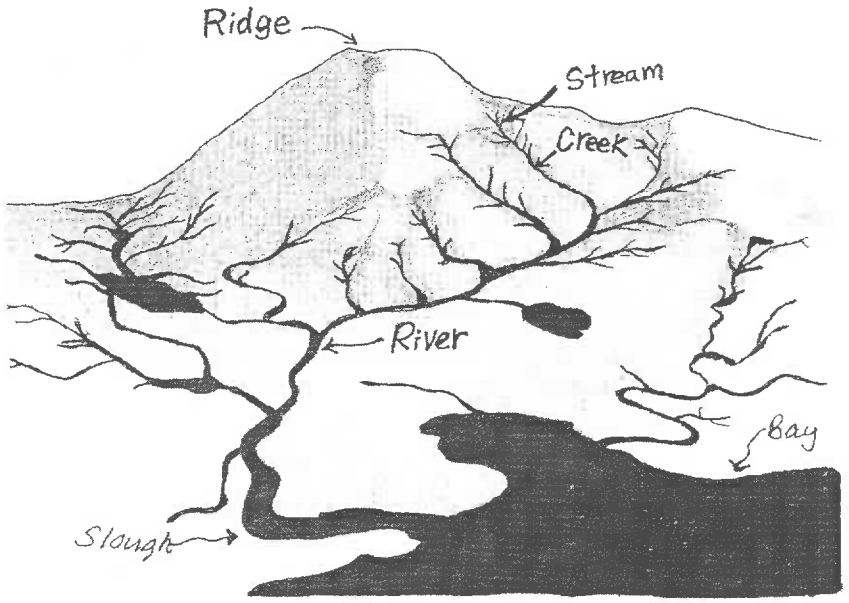
Objectives: Students will be able to:
- define the term watershed.
- name the watershed in which their school is located.
- describe the meaning of runoff and runoff pollution.
- recognize that everyone contributes to and is responsible for the Bay's water quality.

Materials:
- ***Southern San Francisco Bay Watershed*** poster (Please contact the Education Staff at the Refuge to obtain a poster.)
- local road maps
- paper
- class sets of ***water-soluble*** markers: brown, blue, red, orange, black
- class sets of ***permanent*** markers: black and green
- spray bottles, one for every two students
- sponges
- paper towels
- brightly colored *Post-It* dots

Time:
- Part I - 45 minutes
- Part II - 45 minutes

Supporting Information for this Activity

- The entire land area that drains surface water (called runoff) into water channels, such as rivers, creeks and streams, is called a watershed or drainage basin.
- The watersheds of creeks and rivers are separated from each other by land forms of higher elevation called ridge lines or mountain divides. Water falling on each side of the divide drains into different watersheds and collection sites.
- Near the ridge lines, when the slope of the land is steep and water channels are narrow, water moves rapidly. As the slope of the land decreases, the water moves more slowly. The width of the channel increases as smaller channels merge together. Eventually water moves through a wide channel that empties into a body of water such as a lake, bay, or ocean. From an aerial view, drainage patterns in watersheds resemble a network similar to the branching pattern of a tree.
- The body of water that the water flows into gives the name to the watershed. For example, the Coyote Creek watershed would be all the surrounding area from which water drains and then flows into that creek.



collection site (e.g. a creek); therefore, school yards are part of a watershed. Even if a school seems far away from the Bay, it is still connected to it by the nearby creeks, streams and sloughs. The marshes at the refuge get their water from the Bay. So, not only are schools connected to the Bay, they are also connected to the refuge via the water systems (streams, sloughs, wetlands, etc.) within the watershed.

- The San Francisco Bay basin drains 3,870 square miles. The vast majority of the Bay's inflow comes from Central Valley rivers. In the South Bay runoff from local rivers, creeks and streams, combined with water from sewage treatment plants, makes up only 10 percent of the water flowing into the Bay. Major waterways in the south Bay include Alameda Creek, Coyote Creek, San Francisquito Creek, Stevens Creek, and the Guadalupe River.
- The quality of water in the Bay is, to a large extent, a reflection of land uses and natural factors found in its watershed. Everyone bears responsibility for the health of a watershed and the water systems within it. Individual actions, both negative and positive, add up. If the watershed is polluted, in all probability, the Bay will also be polluted. The reason for this is that water picks up pollutants as it runs through both agricultural and urban areas.
- In cities and surrounding areas, pesticides, lawn clippings, soapy water, spilled chemicals, dripped oil and antifreeze will likely be washed through the storm drain system and into a creek, river, or the Bay. Unlike the sanitary sewer system, the storm drain system is not connected to a sewage treatment plant. Water that goes into storm drains eventually ends up flowing, completely untreated, into the Bay.

Teaching Method

Part I (45 minutes)

Introduction

Do

Use the *Southern San Francisco Bay Watershed* poster as a visual aid for the following introduction. (Contact the Education Staff at the Refuge to obtain the free poster.)

Read

- " A watershed is the entire area of land that drains surface water, called runoff, into a specific river, creek, streams, or other body of water.
- "The watersheds of creeks and rivers are separated from each other by land forms of higher elevation called ridge lines or mountain divides.
- "Water falling on each side of the divide drains into different watersheds and collection sites."

"The body of water that the water flows into gives the name to the watershed. Let's use the Guadalupe Watershed as an example."

Do

Locate Guadalupe River on the poster and trace its path from the headwaters high in the mountains to the Bay. Next, find the ridge lines on both sides of the Guadalupe.

Read

"Guadalupe Watershed would be the entire land area between these two divides from which water drains and then flows into the Guadalupe River.

"From a bird's-eye view, a watershed resembles a network similar to the branching pattern of a tree. Let's relate the branching pattern of the waterways to a tree.

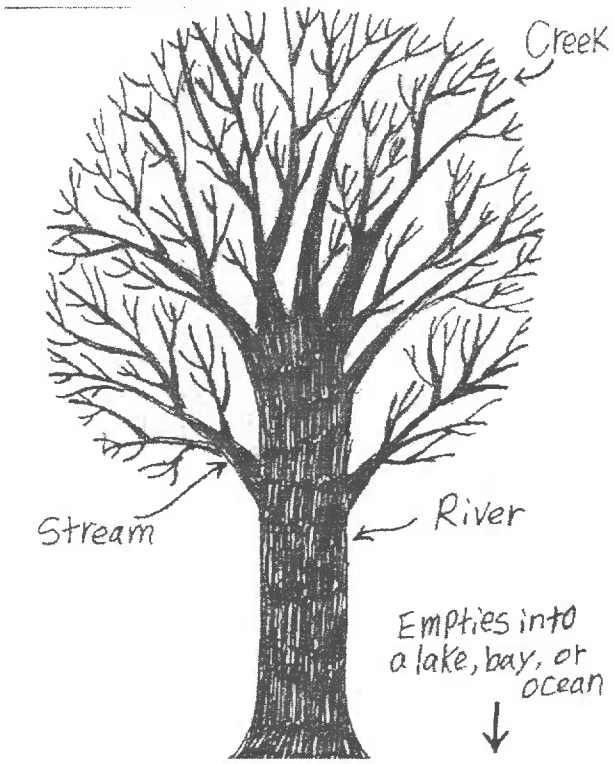
"Waterways, such as creeks, ***begin*** at higher elevations near the ridge lines. Here, where the slope of the land is steep and ***water channels are small and narrow***, water moves rapidly."

Ask

? Which part of the tree would this be?
(Twigs)

Read

"As the slope of the land decreases, the water moves more slowly. The ***width of the channel increases as the smaller channels merge together***."



Ask

? Which part of the tree would this be? (Branches)

Read

"Eventually these channels come together and water moves through an even ***wider channel***."

Ask

? Which part of the tree would this be? (Limb)

Read

"This wider channel then empties into a ***larger body of water*** such as a lake, bay, or ocean."

Ask

? Which part of the tree would this be? (The trunk)

Read

"Now that we have an understanding about how water moves through various waterways and a basic definition of a watershed, lets see if we can increase our understanding of what a watershed actually is."

Making the Watershed Model

Read

"You are going to work with a partner and do an activity where each of you is going to transform a piece of plain paper into a three-dimensional model of a mountain range containing several watersheds."

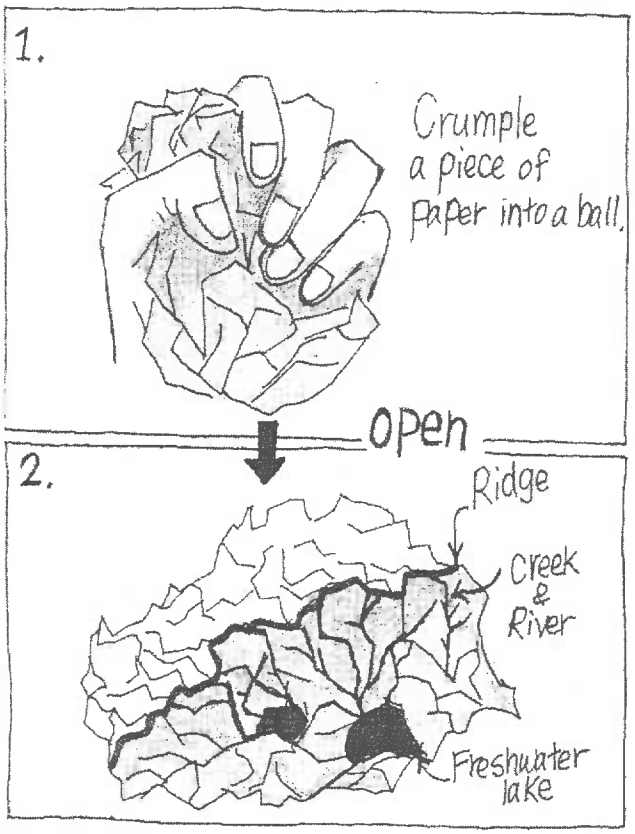
Do

Have students select partners. Then, demonstrate the first step in making the model:

- Crumple a piece of paper into a ball inside your fist. Then gently open the paper so that it sits on the table. ***Do NOT flatten the paper.***
- With some imagination, your paper should look like a miniature range of mountains and valleys.

Read

"I'm now going to pass out the paper so that you may create your own 'mountain range.'"



Do
Help students with the first step. Remind them not to flatten the paper after they open it.

Before passing out the markers, model the next step:

- Use a ***brown water-soluble*** marker to trace the 'ridges' of your 'mountains'.
- Start at the tallest 'peaks' and follow the high point down until it connects with another ridge, or ends in a low spot.

Read
"I'm now going to pass out ***brown*** markers so that you may trace the ridges on your 'mountain range.' It is important that you do this accurately. Remember to start at the tallest 'peaks' and follow the high point down until it connects with another ridge, or ends in a low spot."

Read
[When they are finished]
"Please put down the markers and watch the next step."

Do
Demonstrate the next step in making the model: Use a ***blue water-soluble*** marker to trace the lowest points between all ridges. This is where creeks and rivers flow.

Ask
? What happens at the lowest points where creeks and rivers meet? (Lakes form)

Do
Draw in your creeks, rivers, and freshwater lakes. I'm going to pass out ***blue*** markers for you to create your waterways."

Do
Give students time to work on their models. Monitor their progress and give help as needed.

Read
[When they are finished]
"Please put down the markers and watch the next step."

Do
Demonstrate the next step in making the model: As outlined above, use a ***green permanent marker*** to add vegetation alongside the waterways. These are riparian zones where vegetation can be quite dense.

Again, give students time to work on their models and help as required.

Ask
? Where do people like to put their homes? On a lakeside? Near a creek? In the mountains?

Read
"Use the ***black permanent marker*** I'm passing out to place a small circle where you might like to have your home built.

"When everyone has finished, partners need to compare their models."

Ask
? How are the models similar and different?
? Do they remind you of real mountain ranges?

Read
"Think about what would happen if it rained on your 'mountain landscape'. Where would the water go?"

Do
Review the term watershed: the entire area of land around a waterway that drains runoff into that specific waterway (river, creek, streams, or other body of water).

Read
"Watersheds of creeks and rivers are separated from each other by ridges. If the waterways are creeks, on one side of the ridge, runoff ends up in one creek, and on the other side of the ridge, runoff ends up in another creek."

Do
Have students make predictions about where the water would flow in their model. Have partners take turns: one will watch while the other one points to and marks ***(with an orange water-soluble marker)*** specific spots on their models. Have the students predict where the rainwater will flow to from that point.

Read
"You will each make a prediction about where the water will flow in your model. Take turns and mark one specific spot on each of your models, using the ***orange*** marker I'm going to pass out. Tell your partner where you think the rainwater will flow to from that point when it rains."

Do
Pass out the ***orange water-soluble markers.***

Read
"The spots you all pointed to and marked are part of each stream's watershed. Now it's time to see if your predictions are correct.

"After I demonstrate this next step, I'm going to pass out spray bottles so that you can make it rain. Your partner will check your prediction to see if you were right. "

Do
Before passing out the spray bottles, model this step:

- Hold the spray bottle up above the model so the water is not sprayed on to it but, instead, falls from above.
- Pass out the spray bottles.

Read
"Take turns making it rain. Watch closely to see what happens. The ***water that flows across the surface of the land is called runoff.*** Be patient. It will take several spurts of water before the runoff gets to the low spots and the creeks start to flow. To check your predictions, make sure to pay close attention to the ***orange*** spot and where it flows to."

Do
Examine and share results. Have students put their names on their models using the ***black permanent marker***. Set models in a sunny spot to dry.

Part II (45 minutes)
Understanding Watersheds
Do
Use the *Southern San Francisco Bay Watershed* poster as a visual aid to review.

Ask
? What is a watershed? (A watershed is the entire area of land that drains surface water, called runoff, into a specific river, creek, streams, or other body of water. The watersheds of creeks and rivers are separated from each other by land forms of higher elevation called ridges. Water falling on each side of the ridge drains into different watersheds and collection sites.)

Do
Place a brightly colored *Post-It* dot on the poster near a creek or river. Have a student come up and find the name of the creek or river.

Read
"That's right! That is the _____ River/Creek and the dot is in the _____ Watershed."

Do
Place another brightly colored *Post-It* dot on the poster near a different creek or river. Have a student come up and find the name of the creek or river.

Ask
? What watershed is this dot in? (It will be the same as the river/creek)

Do
Repeat the procedure until everyone understands the concept. You may want to move the dots further from the waterways to make it more challenging as time goes on.

Learning Your Watershed Address
Do
Explain that everyone lives in a watershed for some body of water.

Pass out local maps. Have students locate their school on the map, find the nearest waterway and determine its name.

Ask
? What watershed is our school in? (_____ watershed — NOTE: to determine definitely which watershed you are in may be difficult and is not essential to the success of this activity.)

Read
"That is our watershed address!"

(Optional)
To verify your watershed address consult a topographic map, and by reading elevation lines, try to determine which direction and into which body of water runoff from your school would flow.

A topographic map shows the shape and elevation of the land, waterways, and cultural features such as roads, buildings and bridges. Brown contour lines show the elevation of ridges, hills, and other bumps and dips in the land. The elevation is written in contours as the number of feet above sea level.

Runoff and Runoff Pollution

Read
"Now we are going to learn more about runoff and runoff pollution. I'd like you to get your watershed models and return to your seats. You will be working with the same partner today."

Ask
? What's missing from our models? (Buildings and roads)

Read
"First we will be adding buildings to our watershed models. I will pass out ***black*** markers for you to draw squares or circles to represent buildings. Be very careful not to flatten your model."

Do
Pass out ***black water-soluble markers***. Give students time to work on their models. Monitor their progress and give help as needed.

Read
"Next we will be adding roads to our watershed models. I will pass out ***red*** markers for you to draw lines to connect the buildings. Again, be very careful not to flatten your model."

Do
Pass out ***red water-soluble markers***.

Read
"Finally we will be adding tiny bits of litter to our watershed models. I will pass out ***orange*** markers for you to draw tiny dots near roads and buildings."

Do
Pass out ***orange water-soluble markers***.

Once they are finished, have students make predictions about where the water will flow in their model.

Read
"You will each make a prediction about where the water will flow in your model. Tell your partner where you think the rainwater will flow to from the buildings and roads when it rains."

Do
Pass out the spray bottles.

Read
"Take turns making it rain. Watch closely to see what happens. The ***water that flows across the surface of the land is called runoff***. Check your predictions, make sure to pay close attention to the where the black, red, and orange flow to."

Do
Examine and share results.

Ask
? Where did the runoff go?
? How did it make your waterways look?

Read
"The black, red, and orange flowing into the waterways is called runoff pollution. Take your models back to where they were this morning and then return to your seats."

Ask
? Where do you think the water from our school yard and parking lot goes? (Usually to the waterway previously named.)
? How would it get there? (Most likely through the storm drain system)

Do
Use the *Southern San Francisco Bay Watershed* poster as a visual aid. Locate your school on the poster and place a Post-It dot there. Ask a student to come up to the poster.

Read
"Most of the watersheds in the Bay area flow into a larger watershed called the San Francisco Bay basin. Put your finger on the poster where the school is located. Using your finger, trace the path of the (above) creek/river from our school until it meets the Bay.

"Our water starts here at school, then goes into the _____ creek/river."

Ask
? Where does the water from our school yard end up? (San Francisco Bay)
? Which activities occurring here at school affect, positively or negatively, the water moving across the ground? (positive: sweeping the gutter, picking up litter, etc.; negative: oil in the parking lot, pet waste left in the school yard, etc.)
? Can these activities have an impact on the waterways in our watershed? (Yes)
? Will these activities effect the plants and animals we saw on our field trip to the Refuge? (Yes, marshes at the Refuge get their water from the Bay.)

Do
If students believe their school grounds negatively affect the water quality of their watershed and the Bay, they may want to develop a plan to improve the area.

Extensions
Idea for writing and speaking topics for Language Arts, p. 311.
Students can explore:
- ways their home is connected to the watershed.
- how many different actions they do in a day that connects them to the watershed. Categorize these ideas into harmful or beneficial.